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**Pivots of Operations:
Implications for Operational Sustainment Design**

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**A Monograph
by**

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ABSTRACT

PIVOTS OF OPERATIONS: IMPLICATIONS FOR OPERATIONAL SUSTAINMENT DESIGN by MAJ James M. Castle, USA, 61 pages.

Current U.S. Army and joint sustainment doctrine offers several considerations for the design of operational sustainment in a theater of operations. However, doctrine does not elaborate on how these considerations are interrelated, how they are integrated with the theater concept of operations, or how the operational planner should assess a theater of operations in order to apply them.

Military theory may suggest a possible solution to these doctrinal shortcomings. In the mid-nineteenth century, Baron Antoine Henri Jomini proposed the concept of *pivots of operations*. These were critical geographic nodes that Napoleon used to design his campaigns, and which facilitated both his maneuver and sustainment. The purpose of this monograph was to examine pivots of operations to determine what utility the concept may have for unifying modern operational sustainment design.

In the monograph, I define pivots of operations in the context of Jomini's theoretical writings and relate the concept to Carl von Clausewitz's concept of culmination. I analyze two historical illustrations used by Jomini from Napoleon's campaigns and two twentieth century campaigns to see how the concept has evolved. Based on the historical examples, I summarize the characteristics of pivots of operations and suggest desirable features of modern pivots. Using a hypothetical theater, I demonstrate how pivots may be used today to design the operational sustainment structure for a theater of operations. Then, I compare this model to current and emerging U.S. Army and joint sustainment doctrine to assess their sufficiency. The criteria for analysis throughout are the elements of operational sustainment design enumerated in FM 100-5, *Operations*: lines of support, staging, altering lines of communication, sustainment priorities, and force expansion.

I conclude that the pivots of operations concept provides a common, unifying link between the doctrinal elements of operational sustainment design. Furthermore, it ties sustainment design closely to the theater concept of operations. Finally, pivots of operations offer significant benefits for sustaining the emerging warfighting concept for the future.

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I. INTRODUCTION

The Prussian theorist Carl von Clausewitz observed that as an army projects its strength against an enemy, it expends a portion of that strength in casualties and security operations. If that degradation of strength is not replenished at a sufficient rate, the efforts of the army will inevitably "culminate", and the initiative will pass to the enemy.¹ Sustainment, in military terminology, involves the provision and maintenance of manpower and materiel for the conduct of military operations. Sustainment preserves the material aspects of combat power, promoting the endurance of the fighting forces for continuing operations.

At the operational level of war, sustainment "comprises those logistical and support activities required to sustain campaigns and major operations within a theater of operations."² In modern warfare, sustainment projects massive armies of men, weapons systems, and resources from a base or bases forward toward contact with the enemy. The design for theater sustainment will greatly influence the success of a campaign.

Current U.S. Army and joint sustainment doctrine offer several considerations for the design of operational sustainment in a theater of operations. However, doctrine does not elaborate on how these considerations are interrelated, how they are integrated with the theater concept of operations, or how the operational planner should assess a the-

ater of operations in order to apply them.

Military theory may suggest a possible solution to these doctrinal shortcomings. In the mid-nineteenth century, Baron Antoine Henri Jomini published his theories on the conduct of war based upon his analyses of the campaigns of Napoleon I of France. Among the theoretical concepts Jomini proposed was that of *pivots of operations*. These were critical geographic nodes that Napoleon used to design his campaigns, and which facilitated both his maneuver and sustainment.³ The purpose of this monograph is to examine pivots of operations in their theoretical and historical contexts to determine what utility the concept may have for unifying modern operational sustainment design.

My examination of Jomini's military theory will describe pivots of operations in the context of his "battle-field geometry," his structure for a theater of operations. Having defined what pivots of operations are, I will then relate the concept to the theoretical aspects of sustainment, particularly Carl von Clausewitz's concept of culmination.

Historical examples will demonstrate the validity of theory. Jomini cited at least two examples from Napoleon's campaigns that illustrated his use of pivots of operations. I will analyze those illustrations and two twentieth century campaigns to see how the concept has evolved.

Based upon my analysis of the historical examples, I

will summarize the characteristics of pivots of operations. Since the term is not found in current doctrine, a survey of current U.S. Army and joint services sustainment doctrine will reveal whether a similar concept exists. Application of the concept to a hypothetical theater of war will demonstrate how pivots may be used today to design the operational sustainment structure for a campaign of operations. Finally, I will suggest applications for emerging operational sustainment concepts.

My criteria for determining the utility of the pivots of operations concept will be the elements of operational sustainment design, which are enumerated in FM 100-5, *Operations*: lines of support, staging, altering lines of communication (LOC), sustainment priorities, and force expansion.⁴ Does the concept unify these elements to help operational sustainment planners design the theater sustainment structure? More specifically, as I analyze theory, history, and doctrine, I will seek to answer the following questions:

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|--|---|
| <i>*Lines of Support.</i> | How do pivots of operations assist in defining the direction of support between the sustainment base and the forward sustainment units? |
| <i>*Staging.</i> | How do pivots of operations facilitate the timely forward movement and positioning of resources? |
| <i>*Altering Lines
of Communication.</i> | How do pivots of operations facilitate the redirection of the sustainment effort? |
| <i>*Sustainment Priorities.</i> | How do pivots of operations assist in resourcing the main effort? |

***Force Expansion.**

How do pivots of operations assist in projecting the sustainment structure to support sequential operations?

Jomini believed that theory formed the basis for an understanding of the art of war. He wrote in the conclusion of his *Summary of the Art of War*:

Correct theories, founded upon right principles, sustained by actual events of wars, and added to accurate military history, will form a true school of instruction for generals. . . .

With that in mind, my examination will proceed from a theoretical understanding of the pivots of operations concept through historical applications and analyses to conclusions about its utility for operational sustainment design.

II. THEORY

Antoine Henri Jomini (1779-1869) was a Swiss-born officer who served in the French and Russian armies during the early to mid-nineteenth century. A student of the art of war, he had the opportunity to serve as a staff officer under Napoleon I.⁶ In later years, he proposed military theory based upon the principles he gleaned from the study of the campaigns of Napoleon, Frederick the Great, and other prominent military figures of the seventeenth and eighteenth centuries.⁷ The most comprehensive description of his theory of war is found in *Summary of the Art of War*, which he first published in 1838.⁸

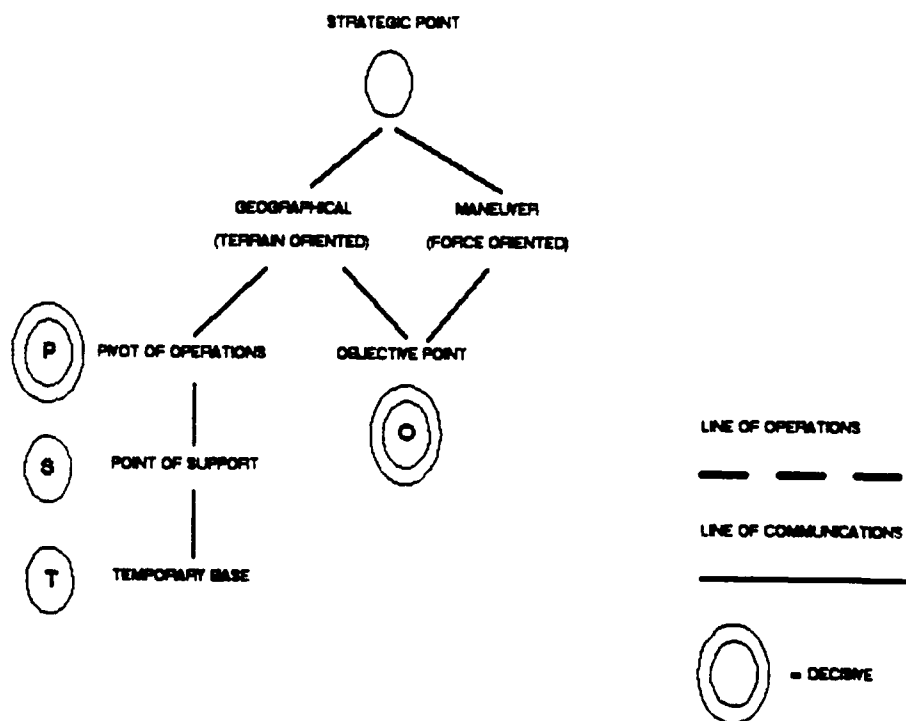
Jomini discussed pivots of operations in the context of

"strategy," which he defined as ". . . the art of making war upon the map, and comprehends the whole theater of operations."⁹ The strategist must carefully analyze the theater of operations, which ". . . embraces all the territory [that an army] may desire to invade and all that it may be necessary to defend."¹⁰ Jomini discussed a lengthy list of the elements of design of a theater of operations, but for the purposes of understanding pivots of operations, the most pertinent are bases of operations, objective points, lines of operations, lines of communications, and geographical strategic points. (Figure 1)

Jomini characterized bases of operations as defensible military positions where reinforcements, supplies, and other military resources are marshalled to support operations in the field.¹¹ Bases may be either fixed and permanently garrisoned, or temporary and positioned to support a particular phase of an operation or campaign.¹²

Armies proceed from and sustain themselves from bases of operations and direct their efforts toward objective points. Objective points are those points which, when successfully seized or retained, achieve the military goals of the operation or campaign. These may be either force- or terrain-oriented, depending upon the commander's priority of destroying the opposing army or occupying key terrain.¹³

The principle axes of the bulk of an army as it moves from its base or bases of operations to its objective point



5a

or points are lines of operations.¹⁴ They are oriented on the objective point or points. When they diverge upon the enemy they are interior lines; when they converge they are exterior.¹⁵

Lines of communication are the trafficable routes that join the subordinate elements of an army with each other and with the bases of operations in the rear.¹⁶ They are the arteries along which forces move, sustain themselves, and coordinate laterally. There may be several lines of communication within a line of operations, each supporting an element of the army within the axis of the army as a whole.

Geographical strategic points focus the definition of the theater of operations. They represent all geographic features that have military importance to the design of the theater.¹⁷ If these points have a conspicuous influence upon the campaign or operation, they are distinguished as decisive strategic points.¹⁸ Lines of operations connect these decisive strategic points as they proceed from the base to the objective point, which is also a decisive strategic point.¹⁹

Jomini only briefly discussed pivots of operations in *Summary*, but it is within the concept of geographical strategic points that we find them. He defined pivots in relation to other geographical strategic points; therefore, cross-referencing these terms is necessary to understand the concept.

Jomini defined a pivot of operations as a geographical point "of both strategical and tactical importance," which serves as a temporary forward base to support a campaign or major operation.²⁰ Pivots are excellent locations for positioning strategic reserves.²¹ When sufficiently secure, they are ". . . almost equivalent to a real base [i.e. permanent, fortified, garrisoned, and within one's own frontiers]."²² Finally, he demonstrated the interrelation of these various terms by stating that ". . . temporary bases and . . . strategic reserves . . . will be doubly valuable if they possess such well-located pivots."²³ What, then, are the desirable characteristics of these related geographical points?

In several instances Jomini used the terms "points of support" and "temporary bases" interchangeably,²⁴ indicating that their characteristics are similar. Like fixed or permanent bases, temporary bases also marshal replacements, supplies, and equipment to sustain the army. However, they are located forward of the fixed bases (i.e. between a fixed base and an objective point), and are used to support a major operation or a particular phase of a campaign. They are ideally sited at the "confluence of great valleys"²⁵, the junction of rivers, and centers [i.e. nodes] of principle lines of communication.²⁶

These points differ, however, in their relationship to the point of main effort. A point of support is a temporary

base that supports a particular line of operations.²⁷ A pivot of operations is a point of support that is situated such that it can support divergent lines of operations, and may, in fact, support forward points of support.²⁸ (Figure 1) Pivots of operations are also decisive geographical points; their possession controls access to a region, and they are ideal locations for strategic reserves.

Strategic reserves involved more than just the uncommitted forces that a general might use to influence his campaign. For Jomini, these reserves included depots where supplies and equipment were marshalled, where replacements were received and trained, and where units could be reconstituted.²⁹ Thus, the collocation of such reserves at forward, centrally positioned communications nodes offered the commander great flexibility and freedom of action. Reserves so positioned permitted him to rapidly reinforce or shift his main effort with forces or materiel. This concept of well-situated resources gives the pivots of operations concept its theoretical utility for operational sustainment.

Operational sustainment is inherently linked to Carl von Clausewitz's concept of culmination. Clausewitz (1781-1831) was a Prussian contemporary and rival of Jomini as an interpreter of Napoleon.³⁰ He observed that as an attacking army progressed from its base, it expended both personnel and materiel to neutralize any opposition and to secure its lines of communication.³¹ This expenditure moved it

inexorably toward the point of diminishing combat power beyond which it could no longer mass superior strength against the enemy to continue to attack, but was, instead, forced to defend its gains. He called that point the "culminating point of victory."³²

Obviously, one means to forestall the diminution of strength is to replenish the expended resources at a rate that sustains the capability to continue the advance. Clausewitz maintained that sustaining the army in the field was an essential requirement of war.³³ As he assessed the impact of inadequate replenishment along over-extended lines of communication, he observed: "Often the finest victory has been robbed of its glory as a consequence of this problem. Strength ebbs away, retreat becomes unavoidable, and gradually the signs of genuine defeat appear."³⁴

Clausewitz, inducing from Napoleon's campaigns, minimized the requirement for a deliberate buildup of supplies prior to the commencement of a campaign.³⁵ Napoleon had achieved his remarkable maneuverability by divorcing his armies from the ponderous baggage trains that burdened eighteenth century European armies. Instead, he foraged and requisitioned supplies from the lands through which he maneuvered; this concept worked quite well in populous and fertile areas.³⁶ Nevertheless, Clausewitz recognized that replacement personnel, equipment, and ammunition must come from the armies' bases of operations. He also recognized

that in winter or in barren, sparsely populated areas other sustaining supplies would have to be pushed forward to the armies. To facilitate this sustainment, he proposed depots with characteristics similar to Jomini's pivots of operations.³⁷

Depots were established on lines of communication that offered the most efficient movement between the armies and their bases of operations. Besides supplies, depots contained ". . . hospitals, relay points and postal services, as well as commandants, field police and garrisons."³⁸ Clausewitz's analysis of lines of communication revealed desirable locations for depots--in larger, wealthier towns; linked by wide, major roads and navigable rivers with bridges as points of passage; and secured by fortresses.³⁹ These considerations ". . . indicate the general influence that questions of supply can exert on the form and direction of operations, as well as [on] the choice of a theater of war and the lines of communication."⁴⁰

My examination of theory has described, as the basis for sustainment, the eventual culmination of combat power caused by the expenditure of resources. These resources must be replaced, and it is the function of operational sustainment to ensure that resources are sufficient for the prosecution of the campaign. Jomini and Clausewitz both identified the need to push resources forward from the base of operations along logistically adequate lines of communi-

cation to the armies in the field. To prevent a pause in the momentum of the campaign, these resources must be positioned forward at locations that facilitate rapid movement to the point of need. Pivots of operations are geographical points that provide such well-positioned resources.

Theory begins to demonstrate how pivots interrelate the elements of operational sustainment design of current doctrine. Axes drawn from the permanent sustainment base or bases through intermediate pivots of operations--as geographical strategic points--to the army define the *lines of support*. As depots or temporary bases of operations, they *stage* resources where they are most responsive to the needs of the army, and *expand* theater sustainment forward as the campaign progresses. The confluence of lines of communication at pivots permits *altering lines of communication* to respond to the situation, and the forward depots and strategic reserves permit redirecting *sustainment priorities* to the point of main effort. Examples from history will demonstrate the use of pivots in the design of theaters of operations and the execution of campaigns.

III. HISTORICAL BACKGROUND

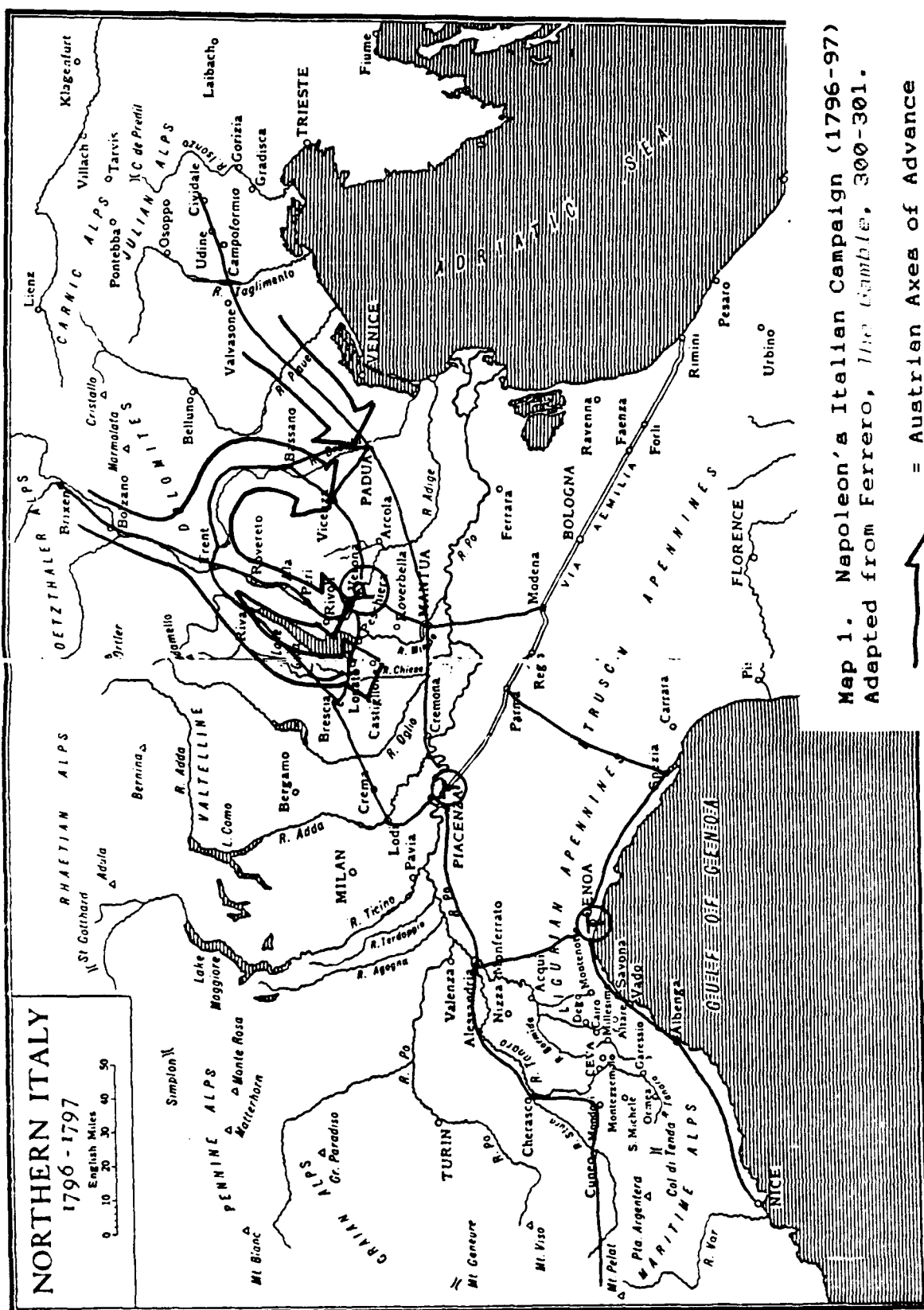
In his discussion of pivots of operations, Jomini cited several instances where Napoleon used this concept effectively to sustain campaigns. Jomini's illustrations and two historical examples from this century will demonstrate how

pivots of operations have helped commanders to design their theaters or areas of operations and execute their campaigns. I will describe the strategic and operational situation, relate how the commander used a pivot of operations, and characterize the features of the pivot.

Napoleon assumed command of the French Army of Italy in March 1796 at Genoa. He then fought a rapid succession of major operations to push the Austrian army out of Northern Italy. By 1 June, he had achieved that goal except for the besieged garrison of Mantua. However, from late July through January 1797, he had to defend his gains against a succession of Austrian counteroffensives aimed at relieving Mantua and liberating the formerly independent duchies of the region.³⁸ (Map 1)

The Austrians launched several offensives along multiple avenues of approach hoping to converge on Napoleon's forces by surprise, deny him time and space to maneuver, and defeat him by superior numbers. Napoleon, however, repeatedly blocked one or more avenues with economy of force operations. Then he pivoted upon the fortress city of Verona, threw the mass of his force against one wing of the Austrian army at a time, and defeated each in succession.³⁹

Jomini highlighted Napoleon's use of Verona as an example of a pivot of operations.⁴⁰ Verona was strategically situated on the Adige River at the confluence of the major avenues of approach through the Alps from Austria into



= Austrian Axes of Advance

Northern Italy. The city guarded the fertile, populous Po River valley, which was essential to the sustainment of Napoleon's army as well as being the economic base of the region. Furthermore, it guarded Napoleon's long line of communication west to Genoa and across the Piedmont to France. Napoleon used Verona variously for his headquarters, as a garrison for portions of his army, and as a forward depot for supplies.⁴¹ That he recognized Verona as an essential feature of his design of campaign is evident from the following quote from Jomini's biography of Napoleon:

. . . It was necessary to be the master of the whole course of the Adige. The fortress of Verona was the key to the river, and the base of any system of operations upon this line. . . . I summoned [captured] Verona . . . on the first of June. This precious acquisition secured to us three fine bridges across the Adige; and the bastioned work, and two strong castles perched on the heights of the Tyrol, hermetically closed the valley on the left of the river.⁴²

The road network emanating from the city permitted Napoleon to rapidly move troops and supplies to support his main effort. Thus, Verona provided Napoleon a secure logistics base, centrally located to support his maneuver against any of several avenues of approach.

Another example cited by Jomini occurred much later in Napoleon's career. By the end of 1812, Napoleon had retreated from his campaign in Russia to Germany. Prussia, Sweden, and Austria mobilized to join the Russians against him.⁴³ Between March and October 1813, Napoleon fought a

campaign to establish a defensible frontier generally along the Elbe River in order to retain Germany against the Allies. Indeed, he hoped to throw a new *Grande Armée* of 656,000 men against each of the Allied armies in turn, before they could complete mobilization and concentrate against him.⁴⁴ He was ultimately unsuccessful, but for several months he was able to delay the Allies on several fronts. Using the city of Dresden as his pivot of operations, he shifted his forces to concentrate against one threat then pivoted to face another. (Map 2)

Dresden was situated astride the navigable Elbe River, and dominated the primary avenue of approach from Austria through the mountains to the south. It also sat at the junction of roads that joined Berlin to the north, Bautzen to the east, and Leipzig to the northwest. It became the terminus of Napoleon's lines of communication which extended back through Leipzig and Hannover to France. A strongly fortified city, Napoleon had extended its defenses and massed supplies and equipment there to sustain the armies. It became the center for his strategic defense.⁴⁵

The larger [of two wings] would adopt a strategic defensive based upon the Saxon capital of Dresden, with the central reaches of the Elbe, the strengthened fortresses of Magdeburg, Wittenberg, Torgau, and the forward positions of Bautzen and Görlitz serving as *points d'appui* (points of support). Dresden itself, with its great depots and camps, formed the kingpin of the entire system. "What is important to me is to avoid being cut off from Dresden and the Elbe," claimed the Emperor. "I will care little if I am cut off from France."⁴⁶

Dresden was the logistical and operational base for Napoleon's far-flung defense of Germany. The substantial stores and extensive road and river transportation system that merged there enabled him to move and support his inferior numbers of troops to achieve local superiority over his divided enemy.

World War I provides a more contemporary example of a pivot of operations. In 1914, the German First Army under General Alexander von Kluck was the right flank formation of the massive German sweep across Belgium into France at the onset of World War I. The offensive began on 2 August, and by 31 August the Allies had been pushed behind the Somme River.⁴⁷ First Army was originally to swing around the north and west of Paris to seize the capital and encircle the Allied armies. However, the sudden collapse of the Allies in front of him convinced Kluck that by shifting his attack to the southeast he could cut them off from their base in Paris and complete their destruction.⁴⁸ As he pushed to the southeast, the French Sixth Army suddenly counterattacked from Paris threatening to roll up the right flank of his army.⁴⁹ (Map 3) He was forced to execute a retrograde flanking movement of his entire army to reorient from an attack to the southeast to defend to the west.⁵⁰ This sudden radical shift of the direction of main effort demonstrates another successful instance of the operational use of pivots of operations.

As the First Army marched across Holland, Belgium and France, it established forward depots along the axis of advance from which to supply the several corps. From Aix-la-Chapelle (now Aachen) in Germany, the line of support proceeded to Tongres and Hal in Belgium, then in France to Cambrai and Chauny. (Map 3) Chauny was the forward depot on 5 September when the French counterattacked.⁵¹ Each of these cities was foremost a rail center, since the vast majority of the sustainment required by First Army had to be moved by rail due to the volume. Furthermore, each was the junction of several roads and lesser rail lines that facilitated distribution of supplies to the subordinate corps.

When the French counterattacked, First Army wheeled upon its western flank, the corps moving back to the north and west to face the new threat. Although planned as an orderly redeployment of the corps, the rapidly deteriorating situation caused a more confused, piecemeal commitment of units to plug gaps.⁵² Nevertheless, the forward depot of Chauny provided a pivot that permitted the Germans to shut off the flow of sustainment to the positions in the south and redirect resources to the new front.⁵³ In many instances ammunition and other critical supplies were already on site when the redeploying units fell in on their new positions. Furthermore, by 9 September a rail line was completed from Chauny to Compiègne which opened a new forward base close behind the new front.⁵⁴

As the strategic situation continued to deteriorate for the Germans all along the Marne, they decided to withdraw behind the Aisne River and establish a strategic defense.⁵⁵ The pivot at Chauny provided communications zone assets forward to the corps of First Army to assist their retrograde, and preserved a strong logistics base for the new defensive positions.⁵⁶

Perhaps one of the most conspicuous modern examples of pivots of operations involved General George S. Patton's U.S. Third Army during World War II. During the spring of 1944, General Patton planned for the campaign of the Third Army across France following the Normandy invasion. Using a 1:1,000,000 road map to analyze his theater of operations, he selected points which he felt would be critical to his campaign. His criteria for selection were centers of road, rail, and river lines.⁵⁷ These points became intermediate objectives and prospective logistics hubs. Indeed, this analytical process was at the heart of Patton's view of operational art. He wrote: ". . . Army and Corps commanders are not so much interested in how to beat the enemy from a tactical standpoint as in where to beat him. The where is learned from a careful study of road, railway, and river maps."⁵⁸

Activated on 1 August 1944, Third Army penetrated the crust of German defenses in Normandy and by 2 September had swept 375 miles to the Meuse River, capturing many of those

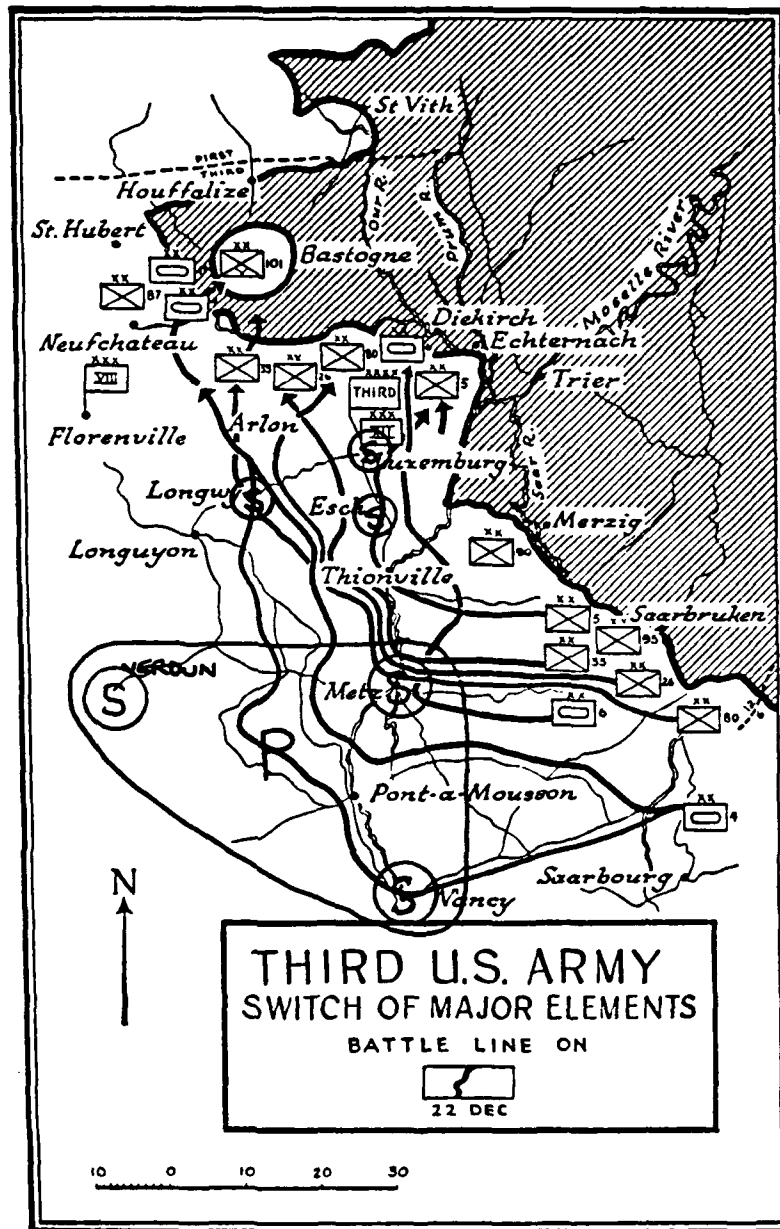
preselected pivots en route.⁵⁹ However, Patton's advance was so rapid that the sustainment structure was unable to keep pace with him. Because the rapid advance did not allow time to build up intermediate depots, supplies had to be transported directly from the invasion beaches of Normandy all the way to the combat forces in contact. The truck transport required to support this effort consumed nearly as much gasoline as it was able to deliver to Third Army.⁶⁰ Finally, reallocation of resources to other Allied forces completely turned off the tap to Third Army.⁶¹ On 2 September, Patton's army culminated, unable to continue the momentum of the advance for lack of fuel and ammunition. Although Third Army seized excellent sites for pivots of operations, the rail and pipeline infrastructure was too badly damaged to stage supplies forward in sufficient quantities to sustain the offensive.

Relieved of the pressure of Patton's advance, the Germans took advantage of his operational pause to consolidate their defense along the Saar River and built up their strength for a counter-offensive.⁶² When it was launched on 16 December against the U.S. First Army on Patton's left flank, he used newly developed pivots of operations to rapidly redeploy Third Army from a line of operations to the east to counterattack north to defeat the German salient.

The Communications Zone (COMMZ) had worked feverishly during the fall of 1944 to expand and improve the theater

infrastructure and stage resources forward to support the armies. By December, rail lines opened as far east as Nancy, Verdun, and Metz, and forward depots were established at these rail and highway centers.⁶³ When Third Army was alerted on 18 December to redeploy to attack north, these points facilitated the maneuver of the corps to the north, and in some cases served to reconstitute divisions en route.⁶⁴ (Map 4) Furthermore, new lines of communication were pushed north from these pivots to open new forward depots at Longwy, Esch, and Luxembourg to support the committed corps.⁶⁵

Each of the examples above demonstrates the historical use of pivots of operations to sustain armies while facilitating operational maneuver. Furthermore, operational commanders from Napoleon to Patton have used the concept of pivots of operations as a rudiment of operational design. We have seen how commanders have selected successive geographical points between their original sustainment base and their combat forces to define *lines of support*. At these points, depots were established to *expand* the theater sustainment system to support expanding forces and operations, and to *stage* resources to provide responsive replenishment. The transportation nets emanating from these pivots provided redundant lines of communication that permitted *altering* those *LOCs* to support changes in operations, and to *redistribute sustainment priorities* to support a new main effort. Fur-



Map 4. Patton's Third U.S. Army - Counterattack Against the Bulge (1944). Adapted from Patton, *War As I Knew It*, 209.

ther analysis of the characteristics of these historical pivots will permit development of a contemporary model of this concept to compare to current doctrine.

IV. ANALYSIS AND COMPARISON

Theory and history have given us several snapshots of pivots of operations. Several salient characteristics emerge; by applying these to present conditions of warfare, we can draw conclusions about the traits of modern pivots. My analysis will identify the essential characteristics of pivots of operations, then propose desirable features for modern pivots. Having defined the concept in contemporary terms, I will propose a model that unites pivots of operations with the elements of operational sustainment design in order to design a hypothetical theater sustainment structure. Finally, I will compare and contrast this model to current and emerging U.S. Army and joint services doctrine to demonstrate its utility.

Based on our theoretical and historical descriptions, the predominant characteristic of pivots of operations is the confluence of communications. Communications in Napoleon's day were the road and river nets along which couriers could travel to coordinate the efforts of armies, and along which units moved and were sustained. Jomini and Clausewitz both proposed siting pivots at the junction of wide valleys. Today, we would call these valleys avenues of

approach. Moreover, as the size of field armies has grown over the last two centuries, the width and trafficability of these avenues have become increasingly important to the movement of these forces.

The concept of communications evolved as the innovations of rail and telegraph expanded the speed of movement and ushered in the era of modern signals. These overlaid additional nets for communications. In this century, air has added a vertical dimension to means of movement. Telephone, microwave relay, radio, television, and satellite communications networks have been developed in part to control the movement of people, goods, and services. The system of all of these transportation and communications networks comprises an infrastructure.

The infrastructure nodes where these modes of communications come together are key terrain at the operational level of war. Their control may dominate one or more avenues of approach, and may aid or hinder both movement and communication in a given region or area.⁶⁶ Indeed, they may be decisive terrain if their retention or seizure are essential to the successful accomplishment of the operational mission.⁶⁷ Certainly, Napoleon felt that the pivots of Verona and Dresden were decisive to his overall efforts for the campaigns in Italy and Germany, respectively. In this century, the pivots at Chauny and Verdun-Metz-Nancy enabled Kluck and Patton, respectively, to radically reorient their

armies to pursue new lines of operations against unexpected threats.

Another common characteristic of the pivots of operations examined is logistical sufficiency. In each of the historical examples, army commanders established advance depots at pivots of operations that were centrally located and sited far enough forward to assist responsive resupply of combat forces at the front. Certainly, the transportation and signal nets discussed above facilitate positioning and management of sustainment resources and distribution forward to the supported units. However, because pivots are often centers of commerce and agriculture, they may also be sources of replenishment. Verona provided forage and rations from the fertile Po River valley to sustain Napoleon's army, and Patton's Third Army "liberated" over three million pounds of frozen and canned beef from a plant near Verdun.⁶⁸

Likewise, the convergence of routes and means of movement combined with consolidated logistics stocks and services make pivots of operations attractive sites for positioning of reserves. Pivots are centrally located and positioned forward, with good access to all sectors of the front--allowing expeditious commitment of the reserve, when needed. Furthermore, since reserves may often be units which are being marshalled upon arrival in theater, or are being refitted after some significant combat, the depots

located at pivots provide facilities and resources for fitting out or reconstituting these forces.

Based on these general characteristics of confluence of communications, logistical sufficiency, and central position, what might be some of the desirable features of modern pivots of operations?

The intelligence preparation of the battlefield (IPB) process identifies avenues of approach.⁶⁹ At the operational level, these avenues ideally permit the laterally distributed movement of corps or even army groups.⁷⁰ This necessitates multiple parallel routes and mobility corridors within an avenue capable of handling the movement of large units.⁷¹ Modern pivots of operations can connect these routes and corridors and define the possible directions that avenues of approach may take.

Modern pivots of operations are situated at the junctions of major highways. These improved roads not only permit rapid tactical movement of combat vehicles within the main battle area, but also allow relatively unimpeded movement of wheeled sustainment vehicles between the base(s) of operations and the front. The transportation terminals at the pivots provide ideal sites for the traffic regulating points and movement control teams. Thus, they can facilitate regulation of highway movements to enhance effective and efficient traffic circulation. This not only prevents nonessential movements from interfering with combat opera-

tions, but enhances continuity and responsiveness of sustenance.

Rail junctions are also desirable pivots. In the more highly industrialized nations, rail continues to haul the bulk of commercial land shipments. Likewise, rail permits the cheapest, fastest, and most efficient means of moving military hardware and bulk resources within a land theater.⁷² Pivots of operations containing railheads permit the rapid movement and marshalling of equipment and supplies forward from the theater base. At these pivots, equipment and supplies can be married with troops to deploy by road forward to the front.

Similarly, in countries where navigable rivers or canals are found, river ports may be desirable as pivots of operations. Indeed, in many third world countries where few highways or rail lines exist, rivers may be the primary means of transportation.

Today, the fastest and most efficient means of moving large numbers of troops between theaters or within the theater rear area is by air. Furthermore, airlift is the fastest means of moving supplies of limited bulk--such as repair parts, and of a variety of emergency supplies and equipment. Airlift also permits rapid evacuation of casualties back to the theater base or out of theater. It is, therefore, desirable to have at least intratheater-capable airfields at modern pivots of operations. Again, multiple

transportation modes at these pivots permit air-shipped items to be transloaded for ground delivery forward.

Since pivots of operations are often used as headquarters, troop marshalling areas, and materiel depots, adequate facilities are desirable. Although these functions can be performed in a large measure using field equipment, fixed facilities offer several advantages. Since pivots are often signals nodes, permanent facilities offer command and control assets that are already tied into the infrastructure of the region. Depending upon the level of war damage, electric power, telephone exchanges, radio, and perhaps even satellite communications assets may offer robust capabilities or backup to field equipment.

Regardless of the expected length of a conflict, some facilities will be required to support a theater sustainment effort. Permanent facilities may offer troop comfort for marshalling areas, hospitals for treatment of casualties, warehousing for supplies, refrigeration for rations, pipelines for petroleum products and natural gas, and covered maintenance facilities. In a mature theater, these may even be hardened for protection of all of these functions. Even in an undeveloped theater, the existence of usable facilities may obviate the need for a deliberate engineer effort to build sustainment facilities. Furthermore, putting military activities and assets inside commercial facilities may disguise or conceal the military nature of those activ-

ities to enhance operational security.

The pivots of operations of Napoleon, Jomini, and Clausewitz were usually fortified cities. Carried to the present day is a requirement that pivots of operations be defensible. Although the vertical threat of air interdiction or missile attack makes any position a possible target, certain qualities of geography still enhance the security of these critical positions. Major rivers to the front or flanks impede large unit maneuver against pivots. Similarly, mountainous and heavily forested terrain restrict mechanized attack. Indeed, the very size and sprawl of some urban areas may provide protection against mounted attack. However, the effects of these restrictions may equally impede friendly mobility between the pivot and the front, rear, or adjacent sectors. Bridges, passes, and other choke points will be critical for both mobility and counter-mobility considerations.

In summary, modern pivots of operations are geographic locations where road, rail, river, and air routes converge to define junctions of mobility corridors. These transportation modes usually feed commercial needs; therefore, these sites often contain extensive industrial facilities and the communications required to conduct commerce and regulate the transportation modes. Such sites may be pre-designated as key strategic or operational locations and may be prepared with hardened military facilities for command

and control or prepositioned logistics stocks. These locations should be situated for effective defense.

Many of these considerations--though not necessarily all--will be present in any specific pivot of operations. However, all pivots of operations offer a forward, central position for sustaining the operational commander's concept of operations. The central concept of pivots of operations is that of well-positioned resources which give a commander flexibility to conduct major operations.

A hypothetical NATO scenario will demonstrate how pivots of operations may be used link the elements of operational sustainment design in order to develop a theater sustainment plan.[†] A Soviet attack has succeeded in re-occupying eastern Germany, pushing NATO forces back to the old Inter-German Border, now called the Inter-Zonal Border (IZB). Allied Forces Central Europe (AFCENT) will contain the Soviet advance along the IZB, receive reinforcing forces from the continental United States (CONUS) and other mobilizing NATO allies, and conduct a counteroffensive to restore the German-Polish border.

The AFCENT commander designates Objectives 1 and 2 as the objectives for Northern Army Group (NORTHAG) and Central Army Group (CENTAG) respectively. The theater bases of operations are the principle depots of forward deployed NATO

[†]This scenario was adapted from an operational decision exercise conducted by the School of Advanced Military Studies, USACGSC, 4-7 March 1991.

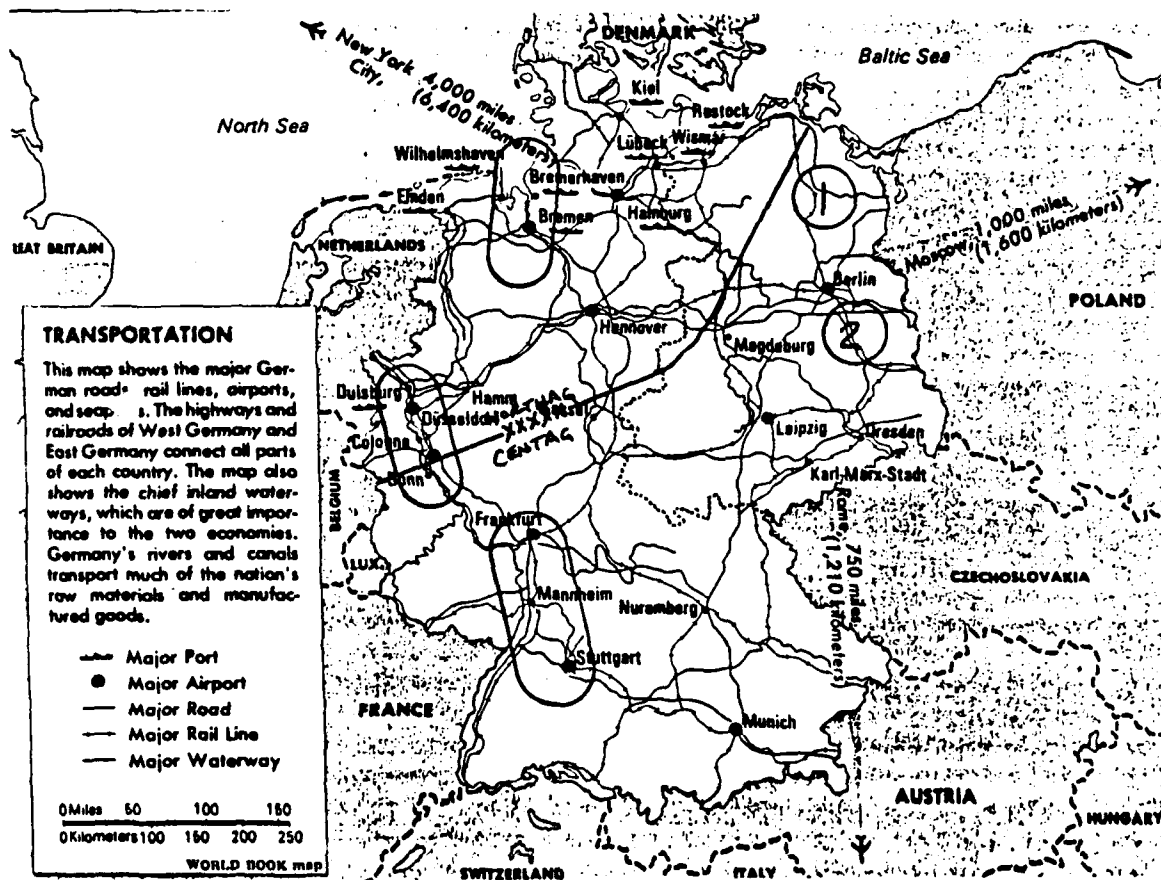
forces, the mobilization sites of the Allies, and the ports and POMCUS^{**} sites for reinforcing forces from CONUS. (Figure 2)

A macroanalysis of the theater of operations between the bases of operations and the objectives reveals several key locations where multiple modes of transportation and communications converge and which sit at the confluence of major avenues of approach. Furthermore, these sites are major commercial centers offering extensive industrial facilities. Many of them have existing military facilities as well. These positions are plotted as potential pivots of operations. (Figure 3)

At this point, the elements of operational sustainment design can be applied. *Lines of support* run from the bases of operations through the pivots to the objectives. (Figure 4) In this scenario we have external lines of support which run from multiple bases of operations along independent lines of communications (LOC) to converge upon the objectives. These lines offer comparative security for theater sustainment in that the multiple bases and LOCs provide redundancy against interdiction.⁷³ Moreover, resources are concentrated toward the objectives to help provide mass to the campaign effort.

Identification of pivots as likely sites for forward

^{**}Prepositioning Of Materiel Configured to Unit Sets. Unit equipment prepositioned in a theater for reinforcing troops from CONUS to draw upon arrival.





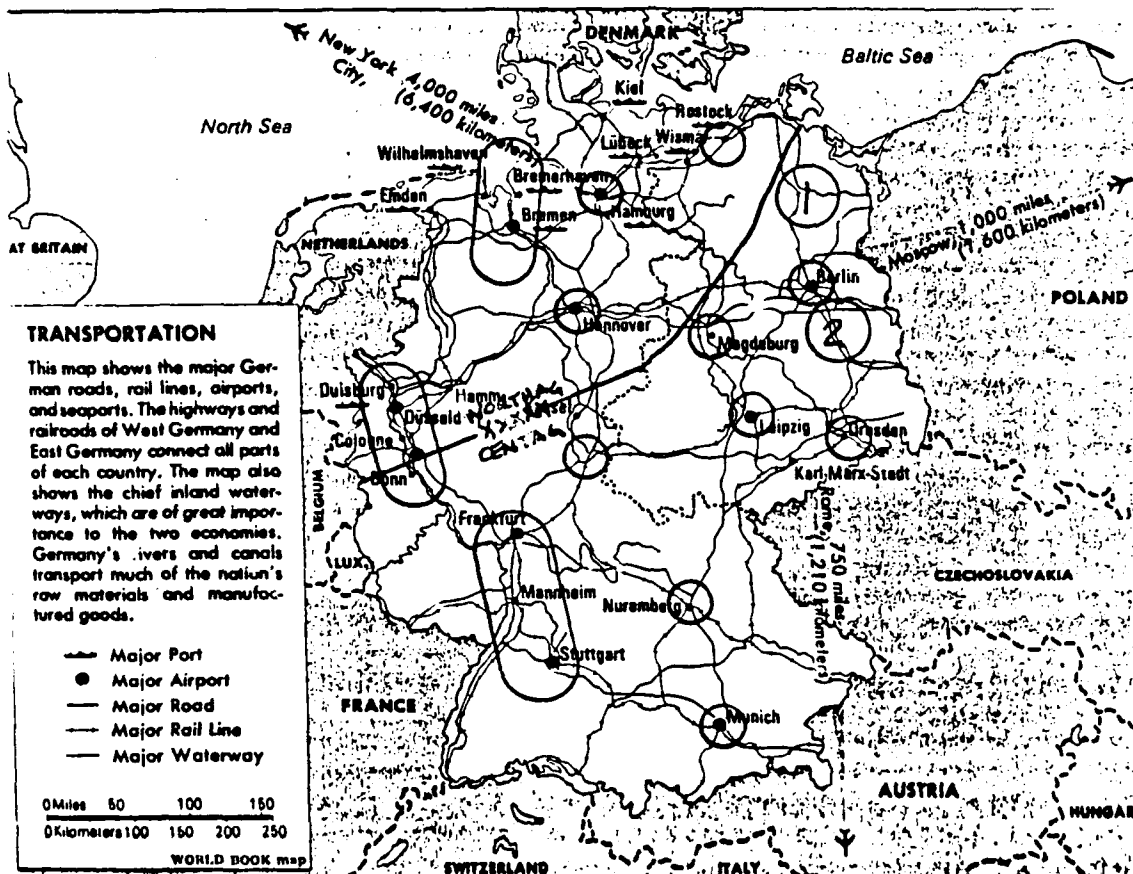
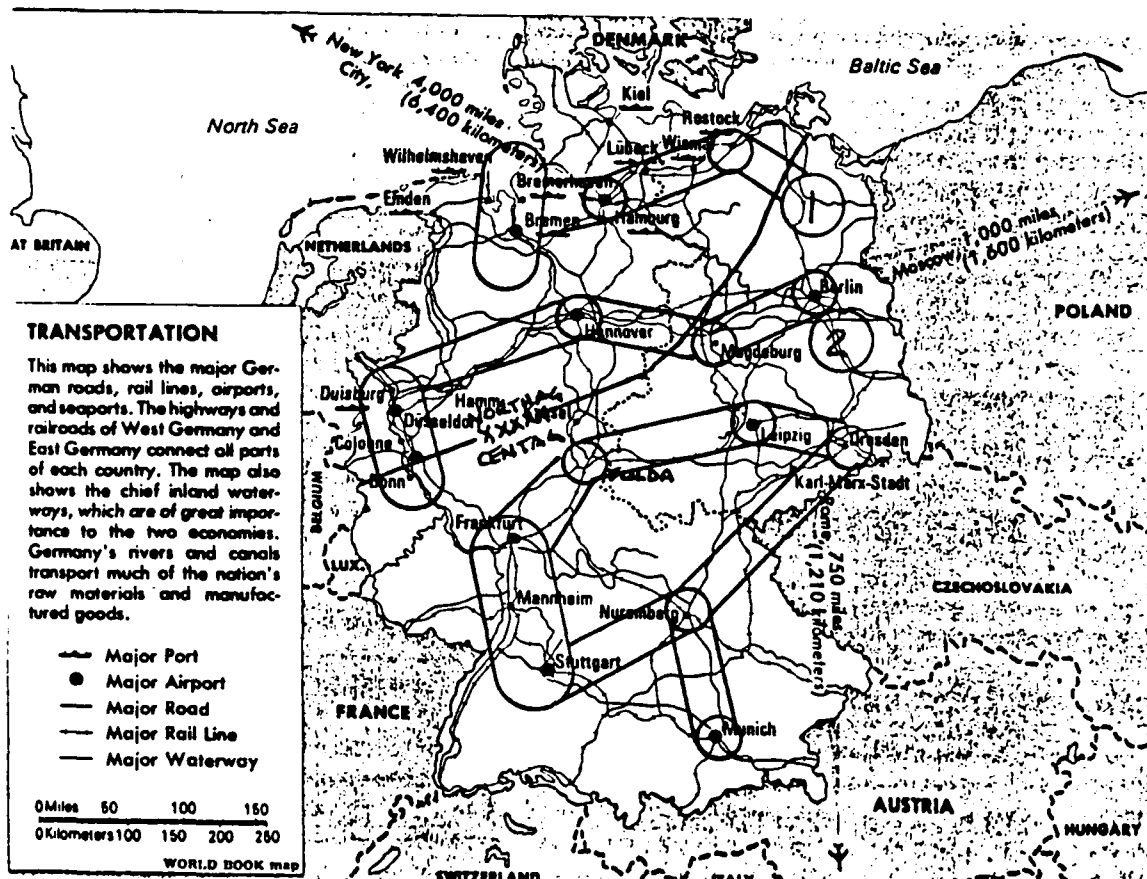
-  = Theater Sustainment Bases
-  = Theater Objectives

Figure 2. Hypothetical Theater Bases and Objectives.
Adapted from *The World Book Encyclopedia*, 1977 ed.,
"Germany."



○ = Potential Pivots of Operations

Figure 3. Hypothetical Theater Pivots of Operations.




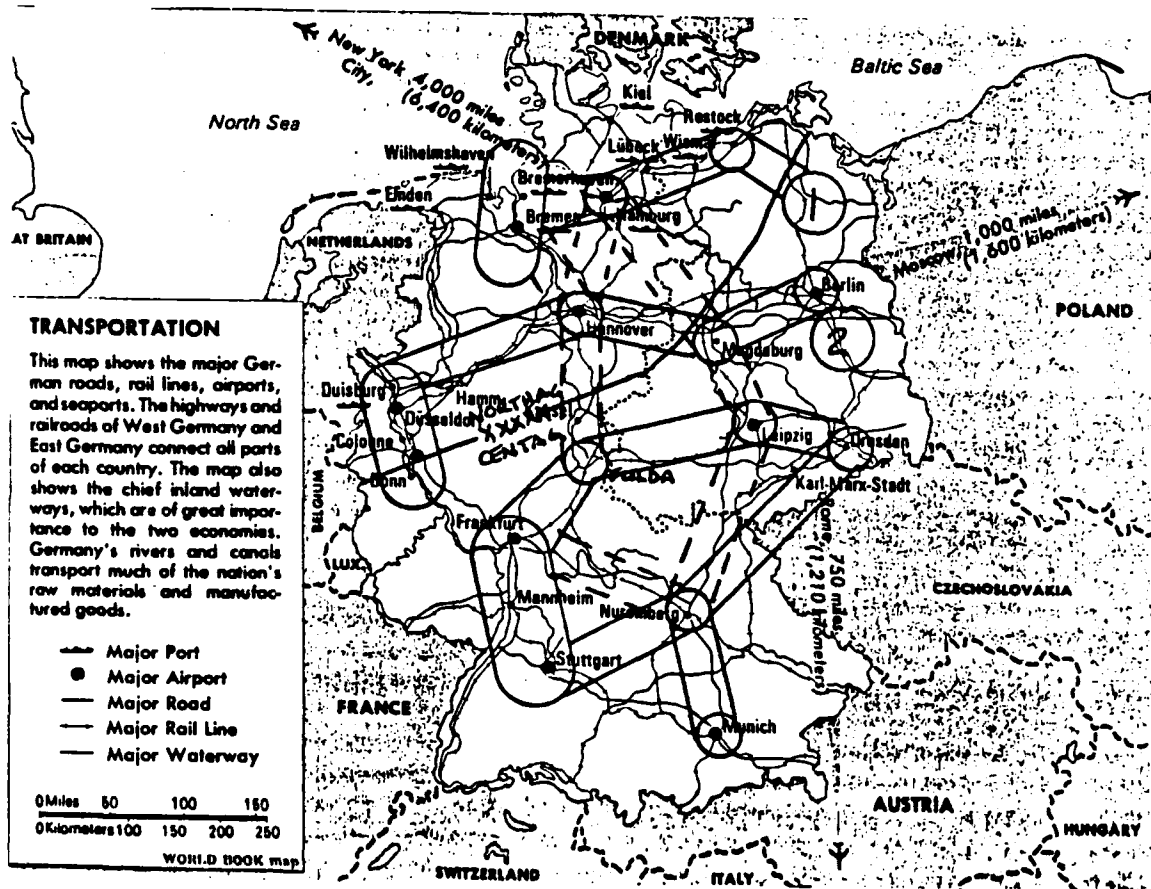
 = Lines of Support

Figure 4. Hypothetical Theater Lines of Support.

support bases is essential to *staging* theater sustainment. As ground forces maneuver, the distance increases from the theater bases. Ultimately, extended lines of communication cease to provide efficient and responsive support forward, and sustainment resources must be positioned forward to remain continuous and responsive. Identified pivots of operations are sites where multiple transportation modes facilitate marshalling and rapid distribution of these stocks.

Pivots of operations not only directly connect the theater bases with the objectives, but they also are laterally connected with each other by multiple means of transportation. (Figure 5) This facilitates *altering lines of communication*. Should a particular LOC be interdicted, pivots of operations offer alternate nodes through which lines can be diverted to the intended destination. If operations require a shift in the direction of support due to a radical change in the concept of operation, pivots provide both a hinge for maneuver and a forward base to support the new line of operation. Patton's counteroffensive against the Bulge in World War II from his pivots at Nancy and Metz demonstrated this utility.

Campaigns phase a series of subordinate campaigns or major operations.⁷⁴ When these phases change, the main effort frequently shifts from one force to another. For example, in the NATO scenario, NORTHAG may be the main



○ — ○ = Altering Lines of Communication

Figure 5. Hypothetical Theater - Altering Lines of Communication.

effort during the containment phase of the campaign; however, after receiving reinforcements, CENTAG could become the main effort to counterattack into eastern Germany. Pivots of operations offer points through which the *sustainment priorities* can be refocused from one force to another. Thus, the "firehose" of logistical effort can be shifted from NORTHAG through lateral and diagonal LOCs to pivots supporting the CENTAG line of support in order to weight the AFCENT main effort.

Pivots of operation may provide locations where existing facilities and infrastructure can be utilized to facilitate *force expansion*. As forces move out and away from the bases of operations, the sustainment structure must expand to meet increased logistical requirements. Resources must be staged forward as previously discussed, but the entire communications zone must increase in capacity as well as space to support increasing forces and consumption. Pivots provide locations and facilities connected by the transportation means to receive the expanded units and resources.

In an undeveloped contingency theater, pivots of operations may have to be created in order to expand out from the lodgement area. In such a case, pivots of operations must first be proposed based upon the concept of operation and terrain considerations; then, the infrastructure must be built or improved. Thus, pivots of operations may be an essential element in the design of theater base development.

Having analyzed the nature of pivots of operations based upon theory and history, we see how the concept can link the doctrinal elements of operational sustainment design. The concept offers a tool for analyzing a given theater of operations and mapping out a structure for the sustainment of the theater war or campaign plan. Comparison to current and emerging U.S. Army and joint sustainment will reveal the greater utility of this concept.

Current U.S. Army Doctrine
for Operational Sustainment Design

FM 100-10, *Combat Service Support*, discusses the logistical applications of IPB. It recognizes that transportation nets and facilities, staging areas and storage facilities, and hospitals and air evacuation sites are of particular importance to logistics planners.⁷⁵ Under operational sustainment planning, combat service support (CSS) planners must analyze the area of operations as one of their chief concerns. After analyzing intelligence data, they select locations for staging areas, depots, hospitals, replacement centers, transportation terminals, and supply routes.⁷⁶ FM 100-10 recognizes that CSS planners must anticipate shifts in the direction of operations and support, and must stage support forward to expand the sustainment effort. However, it does not tie these various considerations together conceptually and relate their importance to the elements of

theater sustainment design.^{***}

FM 100-5, *Operations*, is actually more detailed in its assessment of operational sustainment requirements than FM 100-10. One of the key considerations for operational sustainment planning it discusses is establishment of the sustainment base. Among the criteria it lists for suitability are accessibility to strategic sealift and airlift and internal lines of communications, adequate storage space, and facility for transshipment of supplies. Sustainment bases ". . . must be able to support more than a single line of operations."⁷⁷ These characteristics resemble many of those of pivots of operations, but the publication does not project this concept to the forward bases, nor does it specifically tie the concept to the five elements of theater sustainment design.

FM 100-6 (Coordinating Draft), *Large Unit Operations*, discusses very generally the requirement of the theater of operations commander and staff to assess the capabilities of the support structure in developing the campaign plan. Planners must anticipate movement and consumption throughout the campaign and plan for the expansion and modification of the sustainment support structure--specifically, LOCs and forward staging--in order to avoid culmination.⁷⁸ Furthermore, the theater army commander or COMMZ commander has

^{***}Actually, FM 100-10 lists only four elements; it omits force expansion from the list enumerated in FM 100-5.

general responsibilities to conduct "support, reception, reconstitution, and protection operations."⁷⁹ He provides facilities to "receive, stage, move, and sustain combat forces."⁸⁰ Finally, the theater army commander designs the COMMZ to achieve these ends. In doing this ". . . the availability of facilities and transportation networks (road, rail, air, and water) is a key consideration in determining the location of the sustainment base(s) and LOCs."⁸¹ Again, however, while similarities to the characteristics of pivots and to the elements of operational sustainment design exist, these similar concepts are not integrated in a cohesive concept for design.

FM 100-16, *Support Operations: Echelons Above Corps*, says virtually nothing about the design of operational sustainment structure. It deals almost exclusively with organizations and logistics procedures at the theater army level.

To summarize, current doctrine posits five elements of operational sustainment design, but does not recognize the interrelation of those elements. While it recognizes that transportation and communications nodes are key terrain at the operational level of war, doctrine does not recognize the theoretical value of these nodes as pivots or see them as the integrating concept for the design of operational sustainment.

Emerging U.S. Army Doctrine

The Army is currently revising its warfighting doctrine, AirLand Battle, to reflect the evolution of warfare towards greater nonlinearity, and to account for the draw-down in the size of our armed forces as the result of the changing global political and economic situation.⁸² AirLand Battle-Future (ALB-F) envisions dispersed operations because of fewer forces distributed over large areas.⁸³ Using highly sophisticated technological means, the enemy will be detected at extreme ranges and attacked by precise, lethal fires to heavily attrite him. Maneuver forces then complete destruction of the survivors. Finally, friendly forces reconstitute and prepare for subsequent operations.⁸⁴

Little has been written about operational sustainment under the ALB-F concept. Nevertheless, the concept offers several areas where pivots of operations could contribute to sustainment design.

The dispersed operations of ALB-F will almost certainly result in the intermingling of friendly and enemy forces as they fire and maneuver to destroy each other. This will result in a battlefield on which there is neither front nor rear, units will rarely be capable of mutual support of flanks, and lines of communication will be intermittently secure, at best. To anticipate the likely interdiction of LOCs, the sustainment structure must be flexible, allowing

rapid diversion of sustainment along alternate routes or modes to insure continuity of support. Pivots of operations are the points at which such diversions can be made.

Similarly, in such a fluid theater, the priority of effort must shift rapidly to allow for exploitation of success. Pivots permit the expeditious reallocation of resources and their subsequent distribution by various modes of transportation.

One of the four phases of ALB-F is the reconstitution phase, in which the depleted combat power of the forces is restored. Ideally, if continuous replenishment during the fires and maneuver phases occurs, the substantial rebuilding of forces, requiring an operational pause in operations, may be avoided. However, given the lethality of modern weapons, it is quite likely that during the fires and maneuver phases, units may receive significant losses that will require more deliberate reorganization or regeneration. Under ALB-F, these activities will not necessarily take place in the corps rear area, but may require that the force divert to a location that will better support follow-on missions.⁸⁵

Pivots of operations are excellent locations for such a reconstitution effort. They should contain the transportation terminals to receive replacement personnel, equipment, and supplies; and they may have existing facilities and support units to conduct the required reconstitution functions. Furthermore, the pivot at which units are reconsti-

tuted may support their subsequent commitment on a new line of operations.

The dispersed, nonlinear warfare of ALB-F will provide great challenges to sustainers to support the fluid battlefield. Pivots of operations could provide the flexibility of movement and communications that will be required to ensure continuous, responsive sustainment to the highly maneuverable forces of the future.

Joint Doctrine for Operational Sustainment Design

Joint services doctrine, however, describes a much more cohesive concept for theater sustainment design. JCS Pub 4-0 (Initial Draft), *Doctrine for Logistic Support of Joint Operations*, describes theater design based upon analysis of the "power grid," which is defined as

. . . the transportation and distribution system within a theater. It is composed of lines of communication; ports, bases, and airfields; and service units (military and/or civilian) which operate the ports, bases, and airfields.⁸⁶ (Figure 6)

It is the means by which all of the logistic functional areas (personnel, materiel, facilities, and services) are integrated to produce and sustain combat power.⁸⁷

JCS Pub 4-0 enumerates several considerations for developing a power grid to support a theater of operations. A study of geography can usually define the availability, density, and vulnerability of existing lines of communication. The sustainment planner must consider the efficiency

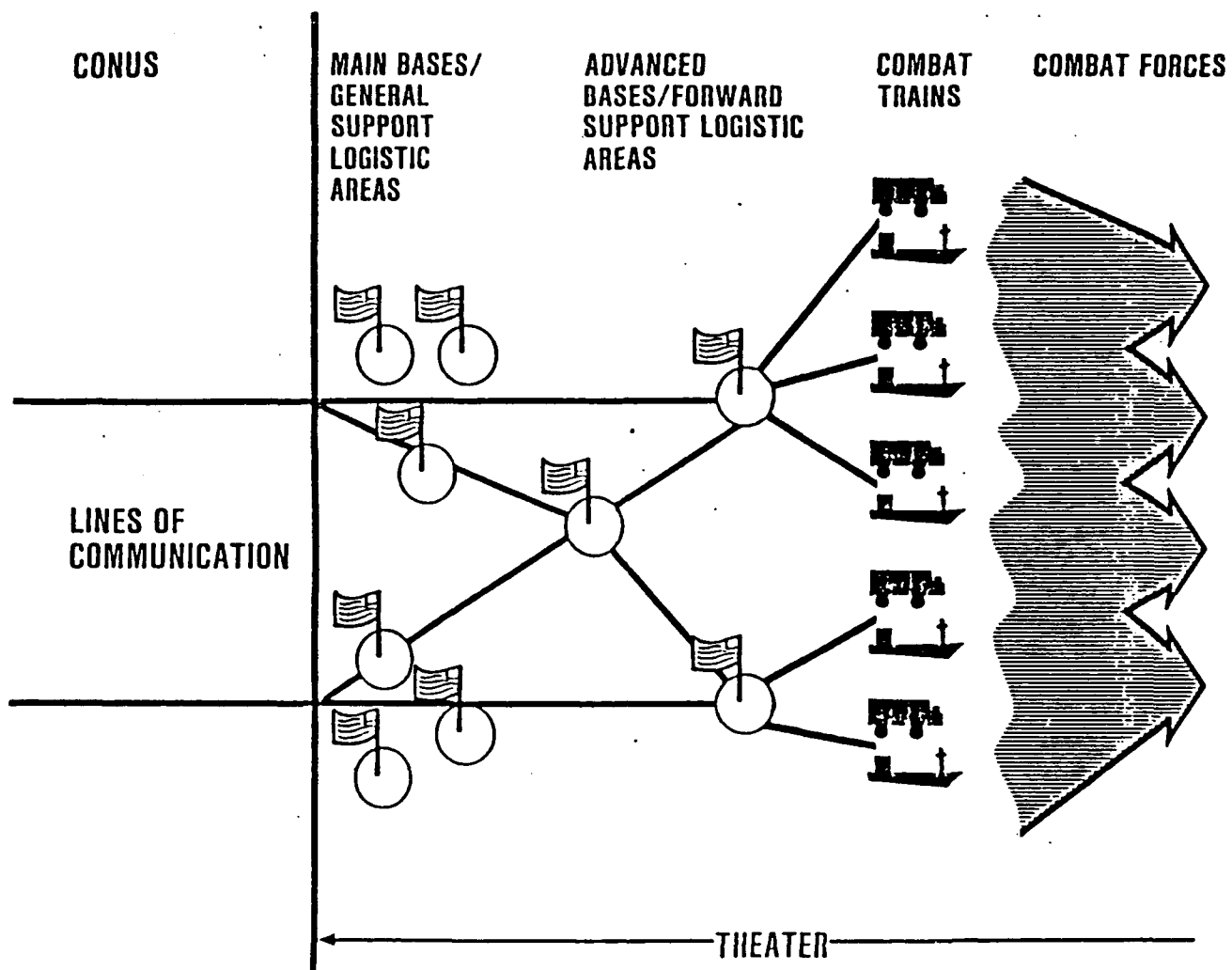


Figure 6. Power Grid. Reprinted from JCS Pub 4-0 (Initial Draft), *Doctrine for Logistic Support of Joint Operations*, Figure V-1.

of the various modes of transportation along those LOCs; e.g., rail is normally the most efficient means of transporting bulk tonnage within theater, while pipelines are most efficient for moving bulk fuels. The throughput capability of those modes determines chokepoints to the efficiency of the distribution system. Therefore, the planner must devise throughput enhancements that can minimize the inhibiting effects of chokepoints, and echelon support throughout the depth of the theater. Finally, he assigns responsibilities for operating the ports, bases, and modes.⁸⁸

Once the capabilities of the theater infrastructure are determined, the logistics directorate (J4) assesses the supportability of the courses of action posed by the operations (J3) or planning directorate (J5). The logistics estimate of the selected course of action is coupled with the proposed power grid structure to derive the logistics concept.⁸⁹

The power grid approach of JCS Pub 4-0 is quite similar in its physical structure to the pivots of operations approach. Not only does the diagram illustrating a power grid closely resemble the final schematic of the pivot-based sustainment structure (Figure 5), but some similarities to the Army's elements of sustainment design are apparent. For instance, echelonment of support implies both the staging of resources throughout the depth of the theater and expansion

of the sustainment network out from the lodgement area. The power grid is an excellent means of analyzing the purely logistical aspects of the theater infrastructure. However, it is developed with little regard for such operational considerations for the design of the theater of operations as objective, lines of operation, and center of gravity or main effort.⁹⁰ The pivots of operations method, on the other hand, is predicated upon designing theater sustainment in conjunction with the concept of operations. It focuses resources where they can best support the commander's main effort, and anticipates support of branches or sequels.

V. CONCLUSION AND IMPLICATIONS

The concept of pivots of operations has been used effectively by commanders of armies since Napoleon's time to design their theaters or areas of operations. Indeed, as technology has expanded our means of transporting and communicating, and consumption of battle resources has increased exponentially, these nodes have become more important than ever to the successful prosecution of war.

Theory proposed that the consumption of battle resources, if unreplenished, leads to culmination of effort. In order to sustain a campaign, resources must be moved expeditiously to the point of need. Historical examples demonstrated that pivots of operations both facilitate movement of resources and provide forward bases for the resources to

be marshalled for responsive resupply.

Analysis of theory and historical examples defined the essential characteristics of pivots of operations and some of their desirable features. Pivots are confluences of communications--the junctions of the road, rail, river, and air routes that define mobility corridors and possible avenues of approach. Furthermore, they are logistically sufficient as forward bases, and contain the receiving, storing, and distribution capabilities to support the combat forces at the front. Finally, pivots of operations are centrally positioned in such a way that they permit the operational commander flexibility and freedom of action to shift his lines of operation or weight his main effort to obtain the advantages of maneuver over his enemy.

Pivots of operations as defined above are not found in current U.S. doctrine. The essential implication of this monograph is that incorporation of the pivots of operations concept into U.S. Army and joint services doctrine is needed to link the elements of operational sustainment design and the elements of operational design to effect a cohesive, integrated structure for a theater of operations. U.S. Army sustainment doctrine posits the five elements of operational sustainment design but does not specify any criteria for their application. Nor does Army doctrine provide a common denominator to integrate operational sustainment and the campaign concept of operations to design a cohesive theater

structure.

The pivots-based operational sustainment design model, on the other hand, offers a systematic means of analyzing a theater of operations to design the sustainment structure. Connecting the bases of operations through identified pivots of operations to the objectives defines the *lines of support* for the campaign. The pivots themselves become likely sites for *staging* resources forward, and for serving as forward depots for receiving, storing, and distributing the means of sustainment. Pivots serve as points from which to *alter lines of communication* to respond to interdiction or support a radical change in the direction of effort. Furthermore, pivots facilitate redirecting assets to support a change in *sustainment priorities*. Finally, as a theater expands outward from the theater base, pivots facilitate the *expansion* of the theater sustainment capacity to support the expanded area and forces.

Pivots of operations also offer utility for AirLand Battle-Future, the Army's emerging warfighting concept. ALB-F does not address operational sustainment design at all. This implies that ALB-F, as an evolution of AirLand Battle, retains the basic design considerations of current doctrine. Thus, the benefits of pivots of operations to the emerging doctrine are the same as described above for current U.S. Army doctrine. However, pivots of operations offer significant implications for sustaining the rapid,

dispersed, nonlinear operations that this doctrinal revision postulates. Pivots will be particularly valuable for shifting lines of support and operations and for the rapid reconstitution of attrited forces.

Pivots of operations could enhance joint operational sustainment doctrine as well. The joint doctrinal concept of the power grid offers an excellent means of analyzing the logistical capabilities of the infrastructure of a region. However, that analysis should help identify pivots of operations to apply to the Army elements of operational sustainment design and to the theater concept of operation. The integration of the power grid and pivots of operations concepts will greatly reinforce joint theater design.

The primary focus of this analysis has been on mid- to high-intensity warfare in a theater which, if not fully mature, at least has a fairly well developed infrastructure. However, as I briefly suggested, one implication of the pivots concept is that in a contingency theater in an underdeveloped region, pivots may need to be identified in order to focus development of the infrastructure to support the campaign. I have not addressed the utility of the concept in a low intensity conflict, where the infrastructure may be practically nonexistent, and where ground LOCs may be largely controlled by hostile forces. But even in these situations, resources must be staged to be responsive, and the transportation and communications nodes will be key loca-

tions for this effort. I sense that the pivots concept will remain valid for theater sustainment design for a low intensity conflict, but more research would be required to substantiate that.

The military theories of Baron Jomini have been eclipsed in recent years by adulation of Carl von Clausewitz. Nevertheless, Jomini was remarkably sensitive to the importance of the logistical considerations for structuring a theater of operations. As technology continues to influence the evolution of warfare, sustainment of materiel readiness will play a dominant role in generating combat power. Jomini's pivots of operations may have even more validity and utility in that environment than in the era in which he proposed them.

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